Teaching guide

IDENTIFICATION DETAILS

Degree:	Architecture
Scope	Architecture, construction, building and urban planning, and civil engineering
Faculty/School:	Higher Polytechnic School
Course:	BASIC MATHEMATICS
Type:	Basic Training
ECTS credits:	6
Year:	1
Code:	3714
Teaching period:	First semester
Subject:	Mathematics
Module:	Propaedeutical
Teaching type:	Classroom-based
Language:	Spanish
Total number of student study hours:	150

SUBJECT DESCRIPTION

This course establishes the concepts that every technician, in particular an architect, must know, in order to be able to develop to their full extent, first, their abilities to study most of the subjects that make up their studies and, second, their tools for the exercise of their profession.
It is therefore an instrumental subject, because its contents will be used by other disciplines. They will be aimed at training in basic knowledge that will allow us to approach the following subjects in a more effective way, giving very relevant importance to the analysis and resolution of problems. This gives it a “service subject” role towards its subsequent employment in “final subjects”.
In any case, this subject will not focus on theoretical concepts, which, although important and due to the limited workload, require a practical application of them, with special emphasis on those concepts that are immediately used.

GOAL

We want students, regardless of the knowledge they have at the beginning of their university studies, to acquire a mathematical culture in which the concepts that govern the world of construction and technology are present.

That he is able to handle the different units with ease, which must necessarily accompany any technical result. Learn the meaning of the mathematical modeling process, as a means of representing abstract concepts in their final form of application to a project.

The specific aims of the subject are:

- Understand the mathematical principles and concepts necessary for the application to the development of architectural processes
- Know how to describe, quantify, analyze and critically evaluate the results obtained in the process of developing a project
- Develop habits of rigorous thinking
- Ability to communicate the knowledge acquired orally and in writing
- Know how to apply the theoretical knowledge acquired to solving problems and practical cases related to different subjects
- Know how to work as a team in an effective and coordinated way.

PRIOR KNOWLEDGE

To study the subject of Physical Foundations and obtain optimal use of the subject, you should have the level of knowledge of the 2nd year of Baccalaureate in the subjects of Physics and Mathematics.

COURSE SYLLABUS

MODULE 0: BASIC CONCEPTS. TOPIC 0: Review of basic concepts. • Trigonometry: - Measurement of angles: Angles, units (radians, sexagesimal degrees, equivalences). - Trigonometric ratios: unit circumference and definitions of sine, cosine, tangent, cosecant, secant, cotangent. Trigonometric formulas (fundamental equations). Pythagorean theorem. • Basic algebra: - Types of 2D conics (parabola, circumference, ellipse, hyperbola). (Origin, definitions and equations) - Exercises for reviewing first and second degree equations. - Resolution of certain compatible linear equation systems. - Operations with logarithms and exponentials.
MODULE I: MATHEMATICAL ANALYSIS OF A VARIABLE. TOPIC 1: Real functions of a real variable. • Function concept. Dominion. Range. Piecewise functions. Graph of a function. Absolute value. • Types of functions: polynomial, periodic, exponential, logarithmic, trigonometric (sine, cosine, tangent, secant, cosecant, cotangent; hyperbolic sine and cosine). Algebraic vs. Transcendent. Examples in architecture. TOPIC 2: Limits and continuity. • Concept of the limit of a function. The origin of modern calculus. Idea and definition of limit. Lateral boundaries.

Limits on piecewise functions. Limits that don't exist (functions with different lateral limits; unbounded functions; oscillating functions). • Analytical calculation of limits: Properties of limits. The limit of a composite function. Indeterminations. Boundary calculation techniques. Sandwich motto. • Continuity: - Idea of continuity. Definition and concept of continuity at a point, in an open interval and in a closed interval. The importance of continuity and its relationship with the limit. Properties of continuity, continuity of a composite function - Types of discontinuities. Functions defined in pieces. - Examples in architecture. TOPIC 3: Derivatives and applications. • Concept of derivative of a function. Geometric and physical interpretation (rate of variation). Basic derivative calculation in architecture (polynomial, exponential, logarithmic, trigonometric and chain rule). • Derivative applications: - L'Hôpital's rule for calculating certain limits. - Extremes of a function. Highs and lows. Concavity and convexity. Inflection points. - Representation of functions through the derivative. TOPIC 4: Integration and applications. • Integral concept of a function. Definite and indefinite integral. Integration techniques. Barrow's rule. • Applications of the integral: - Calculation of areas, lengths and volumes. - Calculation of centers of mass of composite figures. - Moment of inertia. Steiner's theorem.
MODULE II: VECTOR ANALYSIS. TOPIC 5: Vector operations and applications. • Scalars and vectors. Composition of a vector in the XY plane. Unit vector. Module of a vector. Operations with vectors: sum (parallelogram rule), product of a scalar, scalar product of vectors, vector product. • Types of vectors: free, sliding and linked. • Moment of a vector. • Sliding vector systems. Resulting and momentum at a point in a vector system. • Law of changing moments. • Equivalent systems. • Applications in Architecture: - The force vector. Compositions of forces. Resulting. - System of forces. Moment of a force. - Introduction to Statics. Equilibrium Equations (applications under construction). Forces and reactions in supports. Calculation of reactions.
MODULE III: ALGEBRA. TOPIC 6: Matrices, determinants, values and eigenvectors. • Matrix concept and matrix operations. • Determinant concept. • Calculation of the inverse matrix. • Calculation of eigenvalues and vectors. Self-Spaces.

EDUCATION ACTIVITIES

Theoretical classes: Master classes taught by the teacher.
Problem classes: Resolution by the teacher of as many problems as possible, proposing a set of them for the student to solve.
Tutored personal learning: Personalized student attention to review the contents explained in class, answer questions or discuss specific topics in order for the student to achieve the objectives set by the teacher.
Papers and oral presentations: Preparation of papers in groups of students. The works and their content will be detailed in class. The papers will be submitted in writing and an oral presentation will also be made.

DISTRIBUTION OF WORK TIME

TEACHER-LED TRAINING ACTIVITIES	INDIVIDUAL WORK

60 Horas	90 Horas

SKILLS

Basic Skills

Students must have demonstrated knowledge and understanding in an area of study that is founded on general secondary education. Moreover, the area of study is typically at a level that includes certain aspects implying knowledge at the forefront of its field of study, albeit supported by advanced textbooks

Students must be able to apply their knowledge to their work or vocation in a professional manner and possess skills that can typically be demonstrated by coming up with and sustaining arguments and solving problems within their field of study.

Students must have the ability to gather and interpret relevant data (usually within their field of study) in order to make judgments that include reflections on pertinent social, scientific or ethical issues

Students must be able to convey information, ideas, problems and solutions to both an expert and non-expert audience

Students must have developed the learning skills needed to undertake further study with a high degree of independence

Ability to solve problems and to take decisions.

Ability to apply procedures.

Aptitude to create architectural projects that meet both aesthetic and technical requirements.

General Skills

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Specific skills

Applied knowledge of numerical calculus, analytical and differential geometry and algebraic methods.

Appropriate and applied knowledge to architecture and urban planning of graphic survey techniques in all its phases, from drawing notes to scientific restitution.

Appropriate and applied knowledge to architecture and urban planning of the principles of general mechanics,

statics, mass geometry and vector and tensor fields.

LEARNING RESULTS

He knows and understands the main mathematical laws that govern the world and the application of the fundamental methods of Calculus to the study of different technical phenomena.

Knows how to apply vector mathematics as the beginning of solving a problem.

Know and understand the theoretical models that lead to the laws that govern technical processes.

He understands, knows how to apply and solve problems that arise of a geometric nature, both in the phases prior to the project and in its development.

LEARNING APPRAISAL SYSTEM

The evaluation system consists of three fundamental parts for the Ordinary Call:
-Theoretical-practical written exams (70%). Two written exams will be taken to evaluate the learning of the contents presented in the theoretical and problem classes. A partial exam takes place in the middle of the semester and frees up material for the final exam as long as the grade is equal to or greater than 5 points out of 10. If this grade is not passed in the final exam, the student will be examined for all the theoretical contents of the subject. To successfully pass the subject, you must obtain at least a grade of 5 out of 10 in this part.
-Carrying out individual and/or group practical tests (20%). They will be exercises, problems or test-type questions to be carried out in the classroom. The evaluation of the proposed tests allows us to know the pace of learning and to influence, in a general way and also in particular, on the possible knowledge gaps presented by the student. In this part of the grade there is no recovery or minimum grade
-Participation in class development and attendance (10%). Active participation during master classes and intervention in practical tests proposed in class will be positively evaluated. In this part of the grade there is no recovery or minimum grade.
Plagiarism, as well as the use of illegitimate means in evaluation tests, will be sanctioned in accordance with those established in the Evaluation Regulations and the University's Coexistence Regulations.

ETHICAL AND RESPONSIBLE USE OF ARTIFICIAL INTELLIGENCE

1.- The use of any Artificial Intelligence (AI) system or service shall be determined by the lecturer, and may only be used in the manner and under the conditions indicated by them. In all cases, its use must comply with the following principles:
a) The use of AI systems or services must be accompanied by critical reflection on the part of the student regarding their impact and/or limitations in the development of the assigned task or project.
b) The selection of AI systems or services must be justified, explaining their advantages over other tools or methods

of obtaining information. The chosen model and the version of AI used must be described in as much detail as possible.
c) The student must appropriately cite the use of AI systems or services, specifying the parts of the work where they were used and describing the creative process followed. The use of citation formats and usage examples may be consulted on the Library website(https://www.ufv.es/gestion-de-la-informacion_biblioteca/).
d) The results obtained through AI systems or services must always be verified. As the author, the student is responsible for their work and for the legitimacy of the sources used.
2.- In all cases, the use of AI systems or services must always respect the principles of responsible and ethical use upheld by the university, as outlined in the Guide for the Responsible Use of Artificial Intelligence in Studies at UFV. Additionally, the lecturer may request other types of individual commitments from the student when deemed necessary.
3.- Without prejudice to the above, in cases of doubt regarding the ethical and responsible use of any AI system or service, the lecturer may require an oral presentation of any assignment or partial submission. This oral evaluation shall take precedence over any other form of assessment outlined in the Teaching Guide. In this oral defense, the student must demonstrate knowledge of the subject, justify their decisions, and explain the development of their work.

BIBLIOGRAPHY AND OTHER RESOURCES

Basic

Ron Larson Cengage Learning 2016 calculation

Additional

Ferdinand Beer Vector Mechanics for Engineers: Aesthetics (11th Edition) 2017 McGraw Hill
(Ferdinand Beer Vector Mechanics for Engineers: Aesthetics (11th Edition) 2017 McGraw Hill , ||Ferdinand Beer Vector Mechanics for Engineers: Dynamics (11th Edition) 2017 McGraw Hill)